

Observational Research in Face-to-Face Small Groupwork: Capturing Affect as Socio-Dynamic Interpersonal Phenomena

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Abstract

Interpersonal affect in face-to-face small groupwork, though pervasive in university and work environments, is rarely examined as the fine-grained sequential interactions in which it manifests. This review synthesized 21 recent studies in tertiary collaborative learning and organizational research that have used observation methods to investigate affect in face-to-face small groupwork. The analysis focused on examining the extent to which observational studies captured affect as social (interactive) and dynamic (temporally unfolding). Findings showed that observational methods elicit information about affect dynamics in groupwork that is unique and complementary to other methods. Key affect constructs, behavioral operationalizations, and analytical tools used to capture affect are discussed.

Keywords

affect dynamics, group affect, group mood, observational methods, socioemotional interaction

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Capturing the ontological reality of how human interaction unfolds in group activity is the kind of phenomena to which small group researchers refer when highlighting the critical need to “truly open up the black box” of group dynamics to understand how groups function in context (Paletz, 2016, p. 138). Face-to-face groupwork involves perceiving and responding to social cues, continually interpreting myriad momentary affective expressions of multiple actors, which as Hess and Hareli (2019) argued, is typically an automatic, rapid process, and a fundamental means through which we navigate social interaction. The following vignette provides a brief illustration of the pervasive and mutable nature of affect in social interaction:

As I join a new team, I scan the room. A pair speak quietly, quick urgent exchanges, anxious faces. Another on their phone. Behind me a new arrival, drawls, “ah, the A-team”. I turn, encountering a sardonic gaze. My smile freezes. I feel the red creeping up my neck. He continues into the room, repeating “the A-team”. I note my colleague Gerry’s jaw clench. Furtive glances dart around the room, throats clear, almost imperceptible eyebrow lifts. Some history here? I see Gerry compose his face into a welcoming smile, laughingly responding, “now you’re here, absolutely!”, shooting a quick, appealing glance my way. I silently signal back to Gerry with the briefest of nods then smile widely around the room, to support him. The tension breaks. Someone mentions coffee. Smiles, enthusiastic nods.

In their review of research on group affect, Barsade and Knight (2015, p. 22) argued that affect “is an essential piece of understanding group dynamics,” concluding the need to investigate how affect functions moment-to-moment during the interactive, or process domain of teamwork. There is still a limited understanding of what really happens when individuals meet face-to-face to produce a task. This issue is of practical significance as it responds to calls from both tertiary and industry sectors about the need for teamwork-ready graduates (Riebe et al., 2016).

As team-based workplace structures have increased in recent decades there are ongoing demands for tertiary education to deliver collaboration competent graduates, with collaborative learning (CL) now common practice in higher education “to help students develop their teamwork skills” (Curşeu et al., 2018, p. 290). Yet, it is widely acknowledged that successful collaboration does not occur naturally, with challenges inherent in collaborating to learn, and learning to collaborate (Häkkinen et al., 2017). There is continuing reticence among tertiary learners toward groupwork due to perceived issues such as social loafing, unfairness in group grading, difficulties navigating multicultural groups, and inability handling interpersonal conflicts (Riebe

et al., 2016). Similar challenges persist in groups beyond the educational domain, as shown in Van Kleef et al.'s (2017) review of affect in various group contexts, including experimental and real-life workgroups. Their study concluded, "the long-standing quest to understand and manage issues related to diversity, conflict, social loafing, deviance, and lack of information sharing in groups could be informed by considering how the emotional expressions that may be provoked by these challenges shape affective and cognitive processes and concomitant group functioning" (p. 159).

It is thus unsurprising that in both higher education and industry, interpersonal conflicts in teamwork are an acknowledged challenge (Riebe et al., 2016). These two contexts can be viewed as distinct, yet interdependent, as higher education is tasked with producing work-ready individuals, and organizations expected to provide graduate employment opportunities. In both settings it is now acknowledged that peer collaboration is a key feature of effective individual and group performance, and the interdependent nature of actors in achieving personal and collective goals involves interpersonal processes that have often been treated secondary to performance outcomes yet are an important piece of the group dynamics puzzle (Kozlowski & Ilgen, 2006; Riebe et al., 2016). In both contexts, affect management is typically an implicit institutional or organizational expectation rather than explicitly trained or coached for routine interaction, and it is generally expected that groups are capable of self-organizing their collaborative activities and can work autonomously. Given similarities, and shared challenges for education and industry, cross-fertilization between research addressing these two contexts may be mutually informative (Pekrun & Schutz, 2007). This cross-disciplinary review, therefore, integrates the unique methodological perspectives that have been adopted in recent observational studies to examine the function of affect in CL in tertiary education, and in organizational teamwork settings.

Conceptual Background

To acknowledge the interactive and evolving nature of affect in group contexts, the review is framed from a perspective of affect as social, and dynamic. The term *affect* is widely used as an umbrella construct, incorporating affective states such as moods and emotions (American Psychological Association, 2020; Forgas, 1995; Scherer, 2005) and can be conceptualized as two broad dimensions of negative, and positive (Larsen & Diener, 1992). Moods refer to affective states that are more diffuse, enduring, and of lower intensity relative to discrete emotions such as anger and joy, which are usually briefer in duration but more acute in intensity (Forgas, 1995).

A *social* perspective of affect extends traditional foundations of emotions research, which routinely involved decontextualized laboratory studies of individuals, to contemporary perspectives integrating the social nature of emotions (Hess & Hareli, 2019) and affect phenomena more broadly (Kuppens, 2015). Emotion expression and recognition research, for example, has evolved from early samples of facial depictions void of context to their conceptualization as socially embedded, defined by both the immediate and broader sociocultural context in which they occur (Hess & Hareli, 2019). A situated perspective of emotion expressions in their immediate and wider contexts aligns with sociological theories (e.g., Bericat, 2016) illuminating the way in which affect phenomena both shape and are shaped by social life, from the social function of emotions in forming bonds at the microlevel between actors, through to the macrolevel of institutions and cultures (Turner, 2007).

The social nature of affect is also highlighted in the interpersonal skills (IPS) literature. According to Klein et al. (2006), IPS is an overarching term incorporating a range of related concepts such as social skills, people skills, and soft skills, all relevant in teamwork. In their review of the IPS literature, Klein et al. (2006, p. 81) observed that “the capacity to recognize, understand, and manage emotions are critical components” of IPS, involving the ability to perceive and understand the “nonverbal behaviors and emotions” of others (p. 97). Interpersonal skills are fundamental to all social relations, and “the means through which conflicts are resolved, face is negotiated, and predicaments are managed” (Spitzberg & Cupach, 2011, p. 481). Klein et al.’s (2006) IPS framework emphasizes the significance of context, highlighting the way in which behavior appropriate in one situation can be dysfunctional in another. This situated perspective of IPS aligns with the socio-dynamic model of emotions proposed by Mesquita and Boiger (2014), which, consistent with our argument, is based on the premise that emotions are typically derived from social encounters and have a functional role toward cultivating the cohesion of the sociocultural contexts in which they occur.

A *dynamic* perspective of affect acknowledges the essentially mutable nature of emotions. In recent decades scholars have highlighted the importance of the “time-dynamic” (Kuppens, 2015, p. 297) element of affect, evident also in definitions of moods and emotions which capture their varying durations (e.g., Forgas, 1995). Affect scholar, Butler (2017, p. 129) defines emotions as our “temporal interpersonal systems.” A temporal perspective of affect captures its continually evolving nature, which in face-to-face groupwork unfolds within the spatial dynamic of multiple interactants simultaneously responding to myriad ongoing stimuli.

Scope of the Present Review

This article is a narrative review (Baumeister & Leary, 1997), which synthesizes 21 articles reporting empirical studies which used observational methods (video-recording or direct observations) to investigate affect. Hence, this is not a scoping review of the literature on affect in groupwork,¹ but rather, a detailed exploration of how observational studies have examined the complex phenomena of situated visible affect in two distinct but interrelated contexts of face-to-face tertiary CL and organizational teamwork. As argued, we have focused on these two contexts as they both rely on the development and enactment of group interactions at the service of shared tasks as a common operational mode. Moreover, in tertiary education, relational processes have largely been treated as secondary to performance outcomes (Riebe et al., 2016) and likewise in organizational teamwork (Kozlowski & Ilgen, 2006).

In this study we refer to CL in face-to-face groups, defined by Roschelle and Teasley (1995, p. 70) as the “coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem.” Rather than procedurally dividing elements of a learning task for later amalgamation, *collaborative* learning requires individuals to *together* conceptually engage with the problem at hand, in a process by which actors can acquire deep-level subject knowledge through shared problematizing (Summers & Volet, 2010). Dillenbourg (1999) noted an inherent feature of CL is that actors share similar status (e.g., not leader-subordinate or tutor-student groupings) and work together toward a common goal in a manner of negotiation rather than directive decisions arising from formal authority. It is the co-construction of knowledge gained through information sharing, argumentation, and negotiation that can facilitate success (Dillenbourg, 1999; Summers & Volet, 2010).

In the field of educational psychology, research examining the process domain of CL has shown that affect can have a functional role in fundamental group learning processes, such as facilitating effective planning and progress monitoring, and sustaining high-level conceptual discussion (e.g., Järvelä et al., 2016; Järvenoja et al., 2017; Volet et al., 2009). However, research (e.g., Koivuniemi et al., 2018) has also shown that tertiary learners can struggle to navigate affective challenges that arise in CL. Moreover, observational exploration of the functional role of affect in group learning processes has also unveiled “a variety of other socioemotional dimensions that either promote or hinder collaboration” which warrant research attention (Järvenoja et al., 2017, p. 9). Although CL research has identified the need for better understanding of how affective processes influence groupwork, it is at this time a relatively nascent field and so as far as we are aware, there have not yet been any reviews of group affect research in CL.

Research on affect in organizational teamwork, in turn, is well established, as indicated by several research reviews in the past decade alone (e.g., Barsade & Knight, 2015; Knight & Eisenkraft, 2015; Menges & Kilduff, 2015). Following the notion of *group mind* in psychology, affect as group phenomena became of interest in organizational and social psychology (Barsade & Gibson, 2012), with studies showing its collective emergence (e.g., George, 1990) stimulating further research on the functional role of affect in teamwork (Collins et al., 2013). *Group affect* is defined by Barsade and Gibson (2012, p. 119) as “the mutual influence of a group’s context and affective composition (the amalgamation of group members’ state and trait affect).” Extant reviews of the research in organizational literature have found that group affect tends toward homogeneity, creating a collective group mood (e.g., Barsade & Knight, 2015). While a positive group mood has generally been found to influence favorable individual and group outcomes and negative group mood to have the reverse effect, Knight and Eisenkraft’s (2015) meta-analysis found that the impact of negative group affect is dependent on different contextual factors.

This study explores how affect has been investigated as social and dynamic in face-to-face, self-directed tertiary CL, and organizational teamwork contexts, which share several common characteristics (Pekrun & Schutz, 2007). Namely, as discussed earlier, in both contexts the purpose of groupwork is collaborative task production, which is increasingly required for achieving both individual and collective goals. In tertiary education, CL is now widely expected to produce workplace-ready individuals (Curşeu et al., 2018), and in the workplace, the prevalence of self-directed teamwork requires actors to function effectively without continual supervision, making social and emotions skills important not only for executives, but throughout organizations (Klein et al., 2006).

In the workplace, implicit emotion display norms prevail (Geddes & Lindebaum, 2020) therefore some emotions are less likely to be patently expressed, compared to other group contexts such as families and friendship groups. Similarly, institutional norms operate implicitly in tertiary education. It is relevant to point out that in these two contexts there is an underlying expectation that actors will know how to manage emotions without being explicitly trained to do so or without this being determined by professional guidelines (Geddes & Lindebaum, 2020) (e.g., as in health, emergency, or frontline service-oriented fields, or interventional instruction). In summary, these target contexts have been chosen not only because of their commonalities and their pervasive nature, but because some of their inherent attributes (e.g., self-directed groups and implicit expectations that call for emotion regulation and moderation) make affect particularly salient in determining

the nature of group functioning. Yet, in both contexts, the innate interpersonal processes of groupwork remain underexamined as the fine-grained sequentially evolving interactions by which they are routinely enacted.

The contribution of this review is its synthesis of the conceptual and methodological tools that have been used in observational studies to open up the black box of affect phenomena and capture affect as social (interactive) and dynamic (temporally unfolding) in the two broad contexts outlined above. The unique affordances and limitations of observational data for studying affect in groupwork are examined and discussed. Key research directions for future tertiary CL and organizational teamwork, are proposed.

Two research questions were generated for this review:

RQ1: How have the social and dynamic nature of affect been conceptualized and examined empirically in observational studies of groupwork in tertiary CL and organizational teamwork?

RQ2: What are the unique methodological affordances of observation in capturing the social and dynamic nature of affect in groupwork, and what are the limitations?

Method

The review focused on English-language peer-reviewed journal articles published between 2000 and 2019 to capture recent developments in observational studies of affect dynamics. The systematic search procedure commenced with generating four key terms and associated keywords, sufficiently broad for a multidisciplinary database search to cover fields such as educational psychology, communication, organizational science, and industry-specific journals (e.g., engineering; information technology). The first row of Table 1 displays group affect terms typically found in organizational literature. The second row captures general affect terms, used in combination with keywords from the third row, denoting groups, and the fourth row targeting group interaction (i.e., combining affect keywords and interaction keywords).

The systematic search was guided by the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA; Moher et al., 2009). In the first step, the keyword combinations were used to search 16 multidisciplinary databases: Academic One File, A + Education, AnthroSource, Communication Source, Directory of Open Access Journals (DOAJ), EBSCOhost, ERIC, JSTOR, ProQuest Central, PsycINFO, SAGE Journals, Scopus, Sociological Abstracts, Springer Link, Web of Science, and Wiley Online. In all, the database searching produced 8,486 hits. While the large number of hits reflects

Table 1. Constructs and Keywords Applied for Database Search.

Construct	Keywords used for database search
Group affect ^a	Collective emotion; emotion contagion; group affect; group climate; group mood; team affect; team climate; team mood
Affect ^b	Affect; emotion; mood; socioemotional
Task groups	Collaborative learning; cooperative learning; group work; small group; teamwork
Interaction	Group dynamics; group interaction; interaction analysis; team dynamics; team interaction

^aAims to capture group-level constructs used in organizational literature.

^bThe keywords in the second row were used in combination with keywords in the third row denoting *Task groups* and in combination with keywords of the fourth row capturing *Interaction* (i.e., emotion and collaborative learning; mood and group dynamics).

the broad search undertaken, it is noted that the keywords (e.g., interaction analysis; affect) often returned high volumes of titles unrelated to group affect depending on search parameter affordances of databases. Hits included research as diverse as earth sciences, diabetes biology, engineering.

In the second step, the articles identified in step one were screened line-by-line by article titles, and abstracts perused if further information was required. Most of the hits were not relevant to the study, as described above. Four criteria were applied to determine the retention of 79 articles for further examination:

- The focus (or part) of the research aims involved affect in small groups (typically 10 members or less; Reimer, 2016), excluding dyads given their inherent qualitative differences to groups (Moreland, 2010).
- The selection of studies was restricted to tertiary education and organizational teamwork settings. As discussed, this was to gain insight into the affect phenomena that has been targeted as salient, and how they were investigated in these two broad contexts in which adults work interdependently on joint tasks typically set by the organization or institution.
- Small groups working without assigned or official group leaders facilitating interactions, as it is increasingly expected that actors can collaborate successfully without ongoing supervision, in self-directed teams (Klein et al., 2006). Moreover, industry requires tertiary education to provide collaboration-competent graduates, which is commonly addressed through the educational practice of CL (Curşeu et al., 2018).
- Methodology included observations (i.e., video-recording or direct) of face-to-face groups, which can capture both nonverbal and verbal

affect phenomena as sequentially unfolding in the behaviors of multiple actors in real time (Christianson, 2018). As discussed, recognizing not only verbal but also the nonverbal affect signals of others is an important element of IPS (Klein et al., 2006).

The third step involved scrutinizing the 79 articles beyond their abstracts to further establish their fit with other review criteria: empirical studies that used (and articulated the analytical methodology for) observational methods to examine affect phenomena in group interactions. The PRISMA protocol advises documenting the reasons for exclusion of articles at this step. Exclusion criteria were:

- Studies including teachers or tutors in the group. The aim was to capture naturally unfolding affect without assigned leaders or explicit behavioral instruction as previously defined.
- Intervention studies (for the reason above).
- Studies which method of analysis relied on transcripts, or audio-recordings only.
- Studies in which affect was a limited focus, or the observational component unspecified.

Following this selection, 21 articles were retained.² The database search was supplemented by a snowball search involving checking the reference lists of the 21 articles, as well as the reference lists of aforementioned research reviews. No further studies were added from this step. The 21 studies finally retained for in-depth analysis are marked by an asterisk in the reference list.

The narrative synthesis of the studies was informed by Baumeister and Leary's (1997) advice on writing narrative literature reviews. The analysis took place through an iterative process involving repeated in-depth reading of the papers, discussion, and gradual refinement to reveal the key affect constructs, observation indicators, and analytical approaches utilized to unveil affect in groupwork as social and dynamic.

Results

Investigating Affect as Social and Dynamic in Groupwork

This section presents the findings of the first research question, which investigated how the social and dynamic nature of affect have been examined in tertiary CL and organizational teamwork using observational data. An overview of how the 21 studies have conceptualized, observed, and analyzed

affect as social, dynamic, temporally unfolding phenomena in groupwork is provided in Table 2. The first column presents the key affect constructs of each study and notes their social nature. The second column details the visible behavioral indicators of verbal and nonverbal expressions of each of these constructs. The third column identifies the analytical approaches used to examine observed affect data as dynamic. The fourth column lists authors and publication dates.

Before describing the key affect constructs of the 21 studies, it is important to note that the first two studies (Barsade, 2002; Bartel & Saavedra, 2000) were published almost 10 years before the others. This pioneering work has informed subsequent theoretical and empirical research in this area. In their group mood study, Bartel and Saavedra (2000) argued that for affect to converge in face-to-face groups it must be observable in communicative behaviors and therefore visible to researchers. Their observer mood ratings provided “initial support for the idea that the collective construction of work-group mood may result from observable behavioral cues” (Bartel & Saavedra, 2000, p. 222). Their findings were later supported by Barsade’s (2002) experimental research which unveiled the emergence of emotional contagion during group meetings.

Affect constructs: Focusing on its social nature. The first column of Table 2 shows the key affect constructs of each of the 21 studies, noting the social nature and focused valence as positive, negative, or both. For conceptual coherence of the affect constructs, Table 2 presents first the studies that included an inherently collective construct (e.g., group mood, socioemotional climate) or used multilevel (i.e., individual and group) constructs. Following are constructs where the social nature of affect was captured at the individual level (e.g., socioemotional statements; socioemotional behaviors).

The most frequently used term representing affect was socioemotional, cogently combining the targeted focus on the social nature of affect in 11 of 21 studies, applied to seven distinct observable aspects. Specifically, socioemotional *climate* (Poupore, 2018); socioemotional *dynamics* (Sohr et al., 2018); socioemotional *challenges* (Näykki et al., 2014); socioemotional *processes* (Isohätälää et al., 2018); socioemotional *behaviors* (Allen et al., 2018; Lehmann-Willenbrock et al., 2014); socioemotional *statements* (Lehmann-Willenbrock & Allen, 2014; Yoerger et al., 2018); and socioemotional *interactions* (Gorse & Emmitt, 2009; Isohätälä et al., 2019; Motta et al., 2017). In both the CL and organizational literature, socioemotional was conceptualized as the relational sphere of groupwork, distinguished from the group task domain. For example, in CL, social interaction has been conceptualized as having the dual function of learning performance in the cognitive domain, and social performance involving the socioemotional domain (Kreijns et al.,

Table 2. Conceptualizing, Observing, and Analyzing Affect as Social, Dynamic, Temporally Unfolding Phenomena in Groupwork.

Affect construct, social nature, ^a and focused valence	Observation indicators, or observational coding tool for nonverbal and verbal displayed, communicated, expressed affect in groupwork	Analysis of observed affect data (focus on the dynamic domain)	Author/s
Group mood, Pos, Neg	Nonverbal: relating to eight moods, e.g., Facial: frowning, yawning, arching eyebrows; Postural: restless, slouching; Vocal: incredulous tone, rapid pace. Coding tool: Observer's Instrument for work group mood (original). Nonverbal: same as Bartel and Saavedra above.	Frequencies	Bartel and Saavedra (2000)
Group mood Group emotional contagion, Pos Group mood Task-related statements, Pos, Neg	Nonverbal: e.g., flushed face, sneering, eye contact, high pitch, laughter, animation. Coding tool: adapted from Russell et al. (1989), Bartel and Saavedra. Verbal content: e.g., complaining or interest-in-change task-focus statements. Coding tool: act4teams (original). Verbal content: e.g., optimism, enthusiasm, support, affirmation, understanding, esteem, solution-focus behavior. Coding tool: (subset) act4teams instrument (Kauffeld & Lehmann-Willenbrock, 2012).	Frequencies, temporal Frequencies, temporal, patterns Frequencies, temporal, patterns	Barsade (2002) Lehmann-Willenbrock et al. (2011) Lehmann-Willenbrock et al. (2017)
Team positivity	Nonverbal: e.g., Facial: eye contact; Postural: restlessness; Vocal: rapid speech. Coding tool: Activation and valence (based on Bartel and Saavedra). Verbal content: e.g., express care, humor, agreement. Coding tool: interpersonal processes for TWE (original).	Frequencies, temporal, patterns	Costa et al. (2017)
Affective climate Affective interpersonal interactions, Pos	Nonverbal: e.g., clapping, smiling, leaning in, yawning, sighing, no eye-contact. Coding tool: Group Work Dynamic Measuring Instrument (original).	Frequencies, narrative	Poupore (2018)
Socioemotional climate, Pos, Neg	Verbal content, nonverbal: informal + frequent interactions, eye-contact, leaning in, smiling, animation, shared intense focus on task artifacts, no interrupting speaker, excitement, joy, relief, respond all suggestions, questions. No coding tool.	Narrative, patterns	Metiu and Rothbard (2013)
Shared emotion, Pos	Verbal content: expressing confusion, boredom, frustration, regret, complaining, denial, empathy. No coding tool.	Narrative	Imai (2010)
Shared emotions, Neg	Verbal content: proactive statements: e.g., interest-in-change, interest in ideas; supportive statements: e.g., agreeing suggestions. Coding tool: act4teams (Kauffeld & Lehmann-Willenbrock, 2012).	Frequencies, temporal, patterns	Schneider et al. (2018)
Proactive statements, supportive statements, Pos Positive Group Affective Tone (self-report) Affective reactions during interactions, Pos, Neg	Verbal content: solidarity (e.g., empathy, greetings); cheerfulness (e.g., joking, laughing [nonverbal]); antagonism (e.g., autocratic control, status deflating); tension (e.g., frustration; disagreement). Coding tool: Interaction Process Analysis (IPA), adapted from Bales (1950).	Frequencies	Watzek and Mulder (2018)

(continued)

Table 2. (continued)

Affect construct, social nature, ^a and focused valence	Observation indicators, or observational coding tool for nonverbal and verbal displayed, communicated, expressed affect in groupwork	Analysis of observed affect data (focus on the dynamic domain)	Author/s
Socioemotional dynamics, conflict Pos, Neg	Verbal content, nonverbal: talk + paralinguistic cues, e.g., tone, volume, vowel elongation, pauses, forceful gestures, smirking, interrupting, joking, smiling, laughing, leaning into/away, eye-gaze. No coding tool.	Narrative, patterns	Sohr et al. (2018)
Socioemotional challenges, conflict, emotion regulation, Neg	Verbal content: challenging: overruling, undermining, status-centric, normative; Nonverbal: gaze, voice tone, body language, smile, laugh, eye gaze. Coding tool: original categories.	Frequencies, temporal, narrative	Näykki et al. (2014)
Socioemotional behaviors, Neg	Verbal content: Interrupting, side conversations, criticism. Coding tool: act4teams (Kauffield & Lehmann-Willenbrock, 2012).	Frequencies, temporal, patterns	Allen et al. (2018)
Socioemotional processes, Pos	Verbal content, nonverbal: joint participation; joint task focus, active contributing, active listening; humor, jokes, support interactions: gazes, gestures, pauses, speech pitch. Coding tool: original categories.	Frequencies, temporal, narrative	Isohäätä et al. (2018)
Positive humor, socioemotional statements, Pos	Nonverbal: laughter. Verbal content: e.g., humor; praise; encouraging participation; problem-solving behavior codes; positive procedural behavior codes. Coding tool (subset act4teams (Kauffield & Lehmann-Willenbrock, 2012)).	Frequencies, temporal, patterns	Lehmann-Willenbrock and Allen (2014)
Socioemotional statements, Pos	Verbal content: four categories behavioral statements: problem-focused; procedural; socioemotional; action-oriented; Socioemotional: positive: e.g., praising, encouraging participation, supporting. Coding tool: act4teams (Kauffield & Lehmann-Willenbrock, 2012).	Frequencies, temporal	Yoerger et al. (2018)
Socioemotional interactions Pos, Neg	Verbal content: discussing emotions, motivation for task; expressing good team spirit; praising, encouraging group; joking. Nonverbal: laughing, eye contact, attentive listening.	Frequencies, temporal, narrative	Isohäätä et al. (2019)
Socioemotional interactions Pos, Neg	Verbal content: coding categories: supporting, encouraging harmony; inclusivity; positive feedback; undermining harmony: discouraging participation; criticizing; ignoring.	Frequencies	Motta et al. (2017)
Socioemotional interactions Pos, Neg	Verbal content: solidarity, e.g., raise others' status, greetings; Tension release: jokes, laughing [nonverbal]; Antagonism: deflate others' status, block interactions. Coding tool: Interaction Process Analysis (IPA) (Bales, 1950).	Frequencies, patterns	Gorse and Emmitt (2009)
Socioemotional behaviors, task-focus behaviors, Pos, Neg	Verbal content: e.g., problem-focused statements; solution-focused statements; counteractive behaviors (i.e., complaining, blaming); socioemotional: e.g., encouraging, supporting, praising; humor. Coding tool: (subset of) act4teams (Kauffield & Lehmann-Willenbrock, 2012).	Frequencies, temporal, patterns, narrative	Lehmann-Willenbrock et al. (2014)
Emotional, motivational challenges Neg	Verbal content: expressed negative emotions (i.e., anxiety, annoyance, frustration); physical discomfort; low self-efficacy, interest. Social, interaction challenge episodes: difficulties regarding working styles; communication; contextual issues (i.e., time; space; technology).	Frequencies, temporal, patterns	järvenoja et al. (2019)

^aThe italicized words in the first column denote the inherent collective nature of the construct.

2003). In a similar vein, studies influenced by sociologist Bales (1950) distinguished categories of problem-based and socioemotional interactions.

Functional role of affect in groupwork. Across the 21 studies affect phenomena were typically examined for their function toward groups' purpose, with socioemotional constructs conceptualized as playing a functional role in how group members got along together to serve group aims. This includes for example, the role of socioemotional phenomena in different learning processes in CL (e.g., science argumentation, Isohätälää et al., 2018), or in the evolution of highly engaged group task focus (e.g., Costa et al., 2017). Four of the 21 studies that used *socioemotional* constructs, investigated affect also for its functional role explicitly as social. These included relational development (on construction projects, Gorse & Emmitt, 2009); in group conflict (among professionals in a mandatory CL course, Näykki et al., 2014); in group dynamics (in graduate CL groups, Poupore, 2018); and pre-meeting small talk (in experimental groups, Yoerger et al., 2018).

Valence in observational studies of affect. The observational focus on affect as either positive (eight studies), negative (four studies), or both (nine studies) was identified. Four studies (Barsade, 2002; Bartel & Saavedra, 2000; Costa et al., 2017; Lehmann-Willenbrock et al., 2011) were grounded in a circumplex affect model (e.g., Larsen & Diener, 1992; Russell, 1980), which conceptualizes affect on two dimensions of valence on a negative-positive scale, and level of activation. The focus on affective valence rather than discrete emotions is consistent with emotion measure reviews (e.g., Mauss & Robinson, 2009) which have suggested that a dimensional perspective (valence; arousal) may be more suitable for measuring group behavioral data, capturing broad affect phenomena (i.e., mood, climate).

Summarizing, the social nature of affect featured as an innate characteristic of all affect constructs, either as collective, or captured through a focus on individuals in interaction. In contrast, the dynamic nature of affect in groupwork was inherent in just five constructs or studies: socioemotional or affective *interactions*, socioemotional *dynamics*, emotional *regulation*, socioemotional *processes*, and affective *reactions*. In the other 16 studies, the dynamic nature of affect was addressed through the methods of analysis.

Displayed or communicated affect in nonverbal and verbal expressions. The second column of Table 2 shows the range of indicators used to operationalize key constructs, either as distinct coding categories (original or existing tool), or as described behaviors in narrative analyses, with examples of behavioral indicators as nonverbal and verbal expressions. Verbal expression (i.e., negative or

positive valence talk content) and its delivery (e.g., pitch, tone, inflection, pace, volume) as well as nonverbal affect expressions such as facial and bodily gestures (e.g., see Bartel & Saavedra, 2000) were used to investigate the role of affect in group functioning. Eighteen studies utilized coding schemes or categorizations to capture nonverbal or verbal forms of affect phenomena. The observational coding instruments of nine studies were grounded in early interaction analyst Bales' (e.g., 1950) *Interaction Process Analysis* (IPA), focused largely on verbal content as problem-focused or socioemotional.

Noteworthy is the finding that 18 studies identified affect within verbal content, as the predominant focus (10 studies) or in combination with nonverbal affect expression (eight studies), which reflects the importance attributed to affect phenomena in talk in recent research. In the eight studies in which both verbal and nonverbal affect data were examined, some studies analyzed nonverbal and verbal affect independently, for example by employing different coding instruments for each data source (e.g., Costa et al., 2017; Lehmann-Willenbrock et al., 2011). Both nonverbal and verbal affect expressions were also explored together in narrative analysis. For example, Sohr et al. (2018) found socioemotional episodes were readily identifiable in behaviors such as raised voices and striking the table, or humor and postural relaxation signaling group climate recalibration. Studies that focused primarily on nonverbal indicators all operationalized affect as a collective construct: group mood (Barsade, 2002; Bartel & Saavedra, 2000) and socioemotional climate (Poupore, 2018).

Types of affect indicators and the significance of context. In the analysis of indicators, two broad types could be identified: (a) those which depict affect explicitly as expressed (e.g., smiling, scowling, expressing optimism or pessimism, overtly speaking of feeling an emotion) and (b) those targeting behaviors that may elicit affective reactions or influence a group's affective climate over time. This second type was treated as negative or positive in the context of their impact on the groupwork process (e.g., ignoring; inclusivity). These types of behaviors are consistent with affect scholar Scherer's (2005) notion of *interpersonal stance*.

Overall, there was evidence of a breadth of affect indicators and similarity of findings regarding the two types of indicators, with one exception (Motta et al., 2017). Motta and colleagues' study of the function of socioemotional interactions in the learning regulation processes of seven groups of apprentice chefs in CL showed findings that diverged from other CL studies, in that there was no relationship between socioemotional indicators and the quality of the groups' learning processes. The authors speculated that the particular sociocultural context may partly explain their findings, which may be

supported by a recent interview study reporting negative banter and bullying norms in group dynamics of high echelon restaurant kitchens (Giousmpasoglou et al., 2018). These findings highlight the importance of the sociocultural context in affect dynamics (Van Kleef et al., 2016).

In summary, the social nature of the affect constructs was captured by a wide range of observation indicators, highlighting the multiple channels of affect expression embedded within and dynamically unfolding in groupwork, and the different observational foci of researchers. This was particularly evident in two studies in language CL, where the salience of nonverbal forms of communication was revealed (Poupore, 2018), and a linguistic content approach highlighted the way in which affect is embedded in the syntax and discourse of linguistic cues (Imai, 2010). Visible affect phenomena were captured as verbal or nonverbal expressions, or both as complementary indicators. Indicators targeted both relational and explicitly task-focused interactions, identified by coding categories or as descriptors in narrative interpretation. Affect indicators could be direct expressions of affect, or behaviors that either *elicited* an immediate affective response or influenced subsequent affective dynamics of a group (e.g., interrupting, side conversations).

Analyzing the dynamic nature of observed affect data. The third column of Table 2 shows how affect, as visible data in groupwork interactions, has typically been captured through either quantifying coded categories investigating its sequential evolution, or through qualitative analysis. Although interaction analysis may be classified as qualitative research (e.g., Costa et al., 2017), the analysis of observed affect data in the 21 studies contrasts narrative to quantitative analysis of frequencies and numerically derived patterns of coded indicators. Three approaches were identified: quantitative analysis of coded affect indicators; narrative analysis of observed affect as temporally unfolding; and, combination of narrative analysis and quantified indicators to temporally explore affect dynamics.

Quantitative analysis of coded affect indicators of group interactions. As indicated in the third column, counting frequencies of coded data was the most commonly used approach for analysis of coded observational data, with 18 of the 21 studies quantifying coded categories. Further, 15 of these 18 studies reported frequencies in combination with other analysis such as interaction patterns (using statistical methods, such as lag or time series analysis), or narrative analysis. For example, Lehmann-Willenbrock et al.'s (2017, p. 68) discourse analysis of frequencies of positive statements and task-related behaviors in workplace team meetings, revealed that "earlier positivity begets later positivity." Alternatively, Schneider et al.'s (2018)

lag sequential analysis revealed that proactive statements in university project groups also required supportive statements for positive group affect to emerge, illustrating how such forms of analysis can unveil temporally dynamic social affect patterns.

Narrative analysis of observed affect as temporally unfolding in group-work. Three studies primarily used narrative analysis to examine temporally unfolding moment-to-moment affect dynamics, two of them identifying affective patterns in interaction. In the context of university physics groups, Sohr et al. (2018) found a pattern they identified as taking an escape hatch, which comprised interactional moves effectively closing a conversation. Alternatively, in a workplace context, Metiu and Rothbard's (2013) narrative account documented strikingly different interaction patterns involving shared emotion, and its absence in the group processes of two software project teams with different outcomes.

Combination of narrative and quantified indicators to explore affect dynamics. Five studies combined quantified codes with narrative analysis to explore affect phenomena. This involved taking a portion of a dataset for in-depth qualitative analysis as a way of managing the inevitable trade-off between breadth and depth in dealing with voluminous interaction data. Such an approach was evident, for example, in Isohätälä et al.'s (2019) research which took a slice of a larger dataset to explore the interplay of cognitive and socioemotional interactions in temporally fluctuating group participation in six CL groups. The researchers stressed that taking a portion of observational data allowed "a micro-level, moment-by-moment analysis of social interaction" (p. 4).

In summary, the extent to which, and the ways through which the evolution of affect dynamics were examined, varied across studies. To address hypotheses and research questions related to intergroup differences, some longitudinal studies tallied *frequencies* of coded categories across meetings (e.g., Watzek & Mulder, 2018). To investigate temporal evolution, coded categories over a period of time (e.g., Costa et al., 2017; Yoerger et al., 2018) were examined. Some researchers (e.g., Schneider et al., 2018) identified social affect *patterns* in interaction, revealed through statistical analyses. Others (e.g., Sohr et al., 2018) used *narrative* to identify patterns or to zoom-in for closer understanding of phenomena at the microlevel of momentary expressions in episodes and phases. Evident across the studies is the range of "temporal scopes" that different analytical methods can provide, which as Lehmann-Willenbrock (2017, p. 125) observed, can unveil the most ephemeral communications through to groups' defining turning points, or broader patterns. In the context

of affect data, temporal scopes refer to investigations at the microlevel of momentary displays, at the turn level of member utterances, as episodes involving multiple interactions, meeting or task phases, and in unfolding patterns of interaction over the course of one, or more meetings.

Methodological Affordances and Limitations of Group Affect Observation Data

In addressing the second research question, three unique affordances were identified in the analysis of the 21 studies' methodologies, which are presented below before discussing limitations. Unique affordances of observational data included: (a) visibility of affect as socio-dynamic, interpersonal phenomena at both collective and individual-in-interaction levels; (b) availability of both verbal and nonverbal data sources of affect, and; (c) access to the temporally evolving nature of affect as it unfolds in real time.

Affect as visible, socio-dynamic phenomena: Collective and individuals-in-interaction. Depending on the studies' focus, researchers varied the granularity of data analysis to scrutinize the social nature and function of observable affect expressions in groups. The visibility of interpersonal affect that was enabled through observations afforded a focus, and related methods of analysis, either on individuals-in-interaction with others or on the group as a whole. The most commonly applied approach, evident in 12 studies, was observations treated as group-level data by aggregating interactions coded at individual-level. These studies typically relied on verbal expressions of affect. Seven studies used group-level statistical analysis of coded data to investigate the role of affect expressions in eliciting collective theoretical constructs. These were group mood (Bartel & Saavedra, 2000; Lehmann-Willenbrock et al., 2011); positive affect (Lehmann-Willenbrock et al., 2017; Schneider et al., 2018); group engagement (Costa et al., 2017); and team learning behaviors (Motta et al., 2017; Watzek & Mulder, 2018). A similar group-level analytical lens was also employed in five studies to investigate the social nature of affect occurring in everyday behaviors often overlooked as hiding in plain sight. They included the impact of meeting lateness (Allen et al., 2018); relational small talk (Gorse & Emmitt, 2009; Yoerger et al., 2018); the function of humor in teamwork (Lehmann-Willenbrock & Allen, 2014); and intercultural differences in teamwork interaction processes (Lehmann-Willenbrock et al., 2014).

The rarely examined area of intercultural differences in teamwork processes provides an illustration of the valuable insights afforded by examining visible indicators of affect at individual level to understand its nature as a

social phenomenon in different contexts. In their lab-based study undertaken in Germany and the USA, Lehmann-Willenbrock et al. (2014) video-recorded 30 teams performing the same task. Two bilingual researchers exhaustively coded teams' interactions at the individual behavioral level, with an analytical focus on solution- or problem-focused task interactions, procedural talk, socioemotional interactions (e.g., encouraging ideas), and counteractive communications (e.g., pessimism). The coded data were pooled and subjected to separate lag sequential analyses to investigate potential temporal interaction patterns in the German, and US teams respectively, which revealed striking differences. To better understand the different intercultural interaction patterns that the sequential analyses revealed, the researchers then qualitatively analyzed video-recordings, effectively unlocking coded categories to unveil the actual talk behind codes by narrating examples. The distinct patterns identified in the university student lab-based teams also aligned with previous workplace research in each country, suggesting similar interaction styles between the university students and the workplace employees in the respective countries. These findings highlight the additional insights gained through exploring the function of affect in group interaction patterns from wide-view analytical lenses.

The visibility of affect expressed by individuals-in-interaction, and the behavioral processes of the group as a whole enabled the use of multilevel analytical methods of analysis in nine studies. Seven of these studies came from CL research, focused respectively on the function of affect in group learning processes (Imai, 2010; Isohätälä et al., 2018, 2019; Järvenoja et al., 2019; Sohr et al., 2018), group dynamics (Poupore, 2018), and group conflict (Näykki et al., 2014). Barsade's (2002) experimental study investigated emotion contagion among group members at both individual- and group-level, and one workplace study (Metiu & Rothbard, 2013) investigated group engagement using qualitative multilevel analyses.

Analyzing the visibility of affect as both individual- and collective phenomena in real-life groups inevitably involved smaller datasets, since tracing the interplay of individuals in interaction to explore what Braun and Clarke (2006, p. 97) refer to as the "fine-grained functionality of talk," and nonverbal communication, is time consuming. An exemplar is Näykki et al.'s (2014) exploration of challenges that arise during CL. Using a multilevel analytical approach, the researchers explored socioemotional phenomena in the unfolding interaction of individuals, and their manifestation as group-level behavioral processes in one of five groups of professionals in a mandatory university course. Initial viewing of the video-recordings revealed that socioemotional challenges involved multiple interactions, which warranted an episode-level unit of analysis for the challenges identified in the group interactions. The next stage elucidated the group conflict that emerged from the challenging

episodes, and identification of visible emotion regulation strategies in the episodes. The fine-grained video analysis revealed how group conflict manifest from specific overruling, competitive and status perception communications. As the authors acknowledged, a comparative analysis with other group/s may have contributed further insight, since the other groups also experienced socioemotional challenges, but without group conflict.

Overall, the visibility of affect at both collective and individual-in-interaction levels affords valuable insights into its socio-dynamic and interpersonal, interdependent nature. Some studies coded visible affect at the individual, expression level, then shifted the focus to a broader lens using statistical analyses to examine the group-level affect phenomena emergent from interaction. Alternatively, other studies examined affect as individual- and group behaviors by incorporating a fine-grained qualitative element in their analyses to illuminate the microlevel dynamics of individuals in action, tracing the emergence of group behaviors.

Availability of both verbal and nonverbal data sources of affect. A major affordance of observation is the availability of nonverbal data to complement verbal data sources. Nonverbal data, often overlooked in interaction analysis, offer unique additional insight to verbal data sources, and are a “primary medium for the communication of affect” (Bartel & Saavedra, 2000, p. 200). While 10 of the 21 studies relied primarily on verbal data and three on nonverbal data, eight of the 18 studies that examined affect as verbally expressed, also combined nonverbal data in their analyses of observations.

Given the unique affordance of observation for capturing nonverbal displays of affect, the focus of the analysis was on studies that utilized nonverbal expressions as a data source in their analyses. Some studies included laughter as a nonverbal positive affect indicator (e.g., Isohäätä et al., 2019) and in one study on humor in teamwork (Lehmann-Willenbrock et al., 2014), laughter was treated as a key behavioral focus. Other studies that examined nonverbal affect expressions reported a broader array of indicators. For example, Lehmann-Willenbrock et al. (2011) measured group mood in 52 video-recorded team meetings using a nonverbal observation instrument based on the circumplex affect model, which comprised facial, postural, and vocal indicators. Correlations between interaction patterns identified through lag sequential analysis of coded verbal interactions and global group mood ratings from the nonverbal data were calculated to investigate the emergence of group mood from team members’ talk.

Alternatively, using a fine-grained qualitative lens to analyze the function of both nonverbal and verbal affect expressions in the process of science argumentation in CL, Isohäätä et al. (2018) and Sohr et al. (2018) examined how these two data sources functioned in unison to shape group discussions. Taking

Isohäätä et al.'s (2018) research as an exemplar, the researchers forensically examined video-recordings of one of five groups, which had achieved more science argumentation than the other groups in the study. A prolonged argumentation episode of the case group was selected for fine-grained qualitative analysis, which illuminated the ongoing presence of nonverbal affect expressions and their functional role in both the inclusive group atmosphere and the critical discussion. These included, for example, the signaling of respectful listening to divergent ideas, characterized by behaviors such as eye gaze, smiling, pausing, and gesturing. Close attention to the nonverbal and verbal interplay of expressions highlighted their ontological import as sequentially unfolding in group interaction (LeBaron et al., 2018), and the function of affect expressions through which argumentation was successfully navigated.

Although verbal expressions were typically used as the primary data source across the studies, some researchers elaborated on the ways in which nonverbal cues complemented the interpretation of their verbal data. For example, Yoerger et al. (2018) noted that coding verbal expression involved not only what was said but sometimes also the tone of its delivery. Given that reading nonverbal cues is typically an innate, automatic process, the inclination for trained observers to also implicitly interpret nonverbal indicators when coding verbal interactions, has been noted by emotion researchers (e.g., Reisenzein et al., 2014). In sum, although interaction analysis of observed affect has in the main used the content of talk as a primary data source, nonverbal cues are relied upon both explicitly and implicitly when interpreting data and can be an insightful data source.

Accessing the temporally evolving nature of affect unfolding in real-time. Direct access to the evolving nature of affect during groupwork is another major affordance provided by observation. A time-dynamic perspective of affect (Kuppens, 2015) was a key focus in 13 of the 21 studies, using a range of temporal scopes depending on research questions or hypotheses. Two main approaches were evident in analyzing affect as visible sequential data: tracing the evolution of interaction patterns; and temporal analysis at different task phases.

Specifically, eight studies tracked temporal interaction patterns by using statistical analyses of coded verbal data, several using lag sequential analysis. For example, Schneider et al. (2018) examined the emergence of positive affect through the group interactions of 32 teams of undergraduates undertaking final-year software development projects. All verbal interactions of the teams' first project meeting were coded, aggregated to team-level, and then subjected to lag sequential analysis to investigate the role of proactive task-focused statements in eliciting positive group-level affect (self-reports measured post-meeting). In a study with preservice teachers in CL, Järvenoja et al. (2019) also examined temporal interaction patterns in group processes.

To explore if students activated group-level emotion regulation when challenges arose, the researchers segmented video-recordings of 15 groups over six different mathematics tasks at 30-second intervals, observing segments to parse challenges into three categories of *cognitive*, *emotional and motivational*, and *social context and interaction*. The video-recordings were then explored for evidence of group-level emotion regulation, through which four types of collective regulatory strategies were identified. Process modeling software revealed that the three challenge types typically evolved as temporal patterns when collective emotion regulation was not evident. The researchers stressed the unique affordance of the video-recordings in providing new insights for the nascent field of collective emotion regulation in CL that would be difficult to acquire using any other method.

The temporal evolution of affect at different task timepoints was examined in three lab-based studies (Allen et al., 2018; Barsade, 2002; Yoerger et al., 2018) and two CL investigations (Costa et al., 2017; Poupore, 2018). Taking Costa et al. (2017) as an exemplar, their study explored interpersonal processes characteristic of six teams in their final task of an MBA course. Video-recordings were coded at team-level in 30-second segments in two discrete coding stages using separate nonverbal and verbal observation instruments. The teams' verbal and nonverbal coded data frequencies were plotted at six task timepoints, which revealed distinct temporal interaction patterns between higher and lower performing teams. Temporal analysis unveiled a subtle dynamic interplay of both negative and positive group affect at particular phases in more successful teams, compared to the high positive peaks of less successful teams.

Summarizing, the 21 studies provided empirical evidence that observation data offer major affordances to study the social and dynamic nature of affect in groupwork. Visible affect can be examined at different granularities as group-level data, or multilevel by examining individuals-in-action and group behaviors. The availability of nonverbal data sources offer unique, valuable complementary insight to verbal data sources, and access to affect as it unfolds in real-time enables a range of temporal analyses of the interplay of affect in group processes. Yet, while observational methods are well positioned to capture the social and dynamic nature of affective group processes, they are also limited to what is within observational reach, and the observers' interpretations.

Limitations of observations to examine affect in group processes. Of the 21 studies, nine relied solely on observations and 12 used other data to complement observations. The limitations of observational research to understand affect in groupwork are examined in relation to these two groups of studies. In the nine studies that relied solely on observational data, these studies typically addressed reliability of observational interpretation by using inter-rater

reliability coding of a portion of observational data autonomously coded by two or more researchers. However, it was evident that although these studies provided unique insights into the social and dynamic nature of affect in different groupwork contexts, reasons behind behaviors from the actors' perspectives remained unknown. Participants' own perspectives would have revealed valuable insight to complement external observations.

Other methods of data collection that were employed in addition to observations fall broadly into two categories. These included data such as questionnaires or interviews regarding the interaction (process) domain, complementary to observations, which were found in 12 studies. Data that may be viewed broadly as relating to the input (i.e., personality characteristics of group members; contextual information) and output domain of groupwork (i.e., performance outcomes) were found in seven studies. Of the 12 studies that used other methods in addition to observations to investigate group interactions, 10 employed questionnaires or surveys (summarized in the Supplemental Appendix) to elicit individuals' perspectives of their groupwork experiences, and four conducted interviews with individual group members.

Three studies that included interview data were in CL contexts (Imai, 2010; Näykki et al., 2014; Poupore, 2018) and one in the workplace (Metiu & Rothbard, 2013). Imai (2010) and Näykki et al. (2014) used video-stimulated recall interviews to tap into the functional role of expressed emotions in the moment, both of which investigated negative socioemotional interactions, accessing the participants' perspective of the observations analyzed. For example, Imai used video-recordings in interviews to ascertain whether the interpretive analysis aligned with students' own perceptions of the group interactions, triangulating these data with emotion logs and state emotion questionnaire data to develop the narrative analysis, mitigating inferential bias. In their ethnographic comparative analysis of two software projects in the workplace, Metiu and Rothbard (2013) used informal interviews to elicit individuals' perceptions, following events the researcher had identified. Interviews clarified and substantiated researchers' interpretations of events and critically, provided insightful data beyond observational reach. Näykki et al.'s (2014) in-depth analysis of one group (selected on the basis of post-course interviews) illustrates the value of microlevel observational analysis to illuminate how the interdependency of members' responses to socioemotional challenges contributed to the evolution of group conflict. Noteworthy, the authors claimed that it was only through individual interviews that the true extent of emotion regulation, and reasons behind it were revealed.

The survey and questionnaire measures employed in seven studies to elicit data about members' perceptions of their groupwork fell broadly into two domains: those using affect-laden constructs (i.e., groupwork satisfaction),

and those using explicit affect measures. Affect instruments tapped individuals' experienced feeling states for direct comparison with observer mood ratings of nonverbal affect expressions (Barsade, 2002; Bartel & Saavedra, 2000); validated coded observational data (Watzek & Mulder, 2018); substantiated inductive interpretive analysis (Imai, 2010); and were combined with other data sources to measure group dynamics outcomes (Poupore, 2018). Taking as an exemplar Watzek and Mulder's (2018) research on the role of affect in the learning behaviors of interdisciplinary vocational educator teams, the authors reported differences between their self-report findings (obtained using adapted items from the *Positive and Negative Affect Schedule* [PANAS]; Watson et al., 1988) and their observational analysis. The observational analysis revealed that teams with highly effective learning behaviors displayed not only the most positive affect but also the most negative, contrasting with self-report results indicating these teams had experienced the least negative affect. Probing these findings further through exploratory interviews with individuals from those teams may have allowed further insight on the divergent findings.

Alternatively, Schneider et al. (2018) employed the PANAS (Watson et al., 1988) to measure teams' collective affect post-meeting, and aggregated results to team-level to investigate whether positive task-focused interaction patterns identified during meetings elicited collective group affect outcomes. Finally, Costa et al.'s (2017) teamwork engagement questionnaire measured collective engagement as a positively activated state, before and following the teams' video-recorded task, and aggregated team-level results to validate the groups as highly engaged teams.

Three studies (Allen et al., 2018; Isohätälä et al., 2018; Yoerger et al., 2018) used measures such as satisfaction, and group cohesion to elicit participant perspectives of their groupwork. For example, Isohätälä et al.'s (2018) study of socioemotional processes in CL argumentation obtained group satisfaction, cohesion, and psychological safety data from a collaborative learning experience questionnaire administered post-course. While validating the socioemotional processes apparent in video-recordings, the authors noted their microanalytical case analysis of a prolonged argumentation episode was limited by its inaccessibility to the students' own experienced feeling states during the interactions, revealing also the limits of the self-report measures to directly tap specific events.

Departing briefly from the interaction analysis domain, is consideration of other variables, which may be understood broadly as input and outcome data associated with the affective behaviors under investigation. Such data were collected in seven studies (see the Supplemental Appendix). Variable data include personal characteristics (i.e., trait affect), individuals and groups' relational history, and broader inputs (e.g., contextual norms), and outputs

(e.g., group performance outcomes). An illustrative example is Metiu and Rothbard's (2013) ethnographic study, which identified situational and organizational characteristics influencing more informal and formal interactive structures at two workplaces, revealing the important role that wider contextual elements played in group engagement.

Discussion

This review of how recent observational studies have examined visible affect in tertiary education CL and organizational teamwork contexts as socio-dynamic phenomena, revealed the unique methodological affordances offered by observations, and how these complement other methods. The findings are discussed in reference to studies nested in these two settings only and should not be generalized beyond them. Addressing the first research question led to the identification of key affect constructs, behavioral indicators, and analytical methods, highlighting what Christianson (2018) called the audible, visible, and temporal affordances of observations. It uncovered the range of ways in which the social and dynamic nature of affect has been conceptualized, operationalized, and analyzed.

The second research question, addressing the unique methodological affordances of observations to study affect in the two broad contexts examined, showed how the construct of affect has been explored as a multilevel phenomenon (i.e., individual-in-group; group-level). This allowed the opportunity to investigate affect dynamics with varying granularities of analysis, either as group processes or expressed by individuals as interdependent actors. Multilevel perspectives can also include intragroup relationships (i.e., dyadic, triadic), which were found only rarely in this review. This is an important line of inquiry for affect dynamics (Humphrey & Aime, 2014; Keyton, 2000), as shown by Näykki et al.'s (2014) fine-grained interaction analysis of conflict emergence, aided by dyadic interdependencies that developed as members provided support to, or elicited it from particular other/s.

Several studies supported the value of nonverbal affect data as a unique, rich source of information on group dynamics to complement verbal content, which is consistent with sociologist Turner's (2007) claim that humans are evolutionarily hard-wired for nonverbal expressions, which we learn preverbally. Nonverbal communication is continually embedded in talk (Richmond et al., 2012), and as Bartel and Saavedra (2000) argued, is a key means of affect expression, underscoring the importance of studying affect dynamics in both nonverbal and verbal data sources. Moreover, in contexts where overt emotion expressions are implicitly discouraged, nonverbal expressions may be particularly salient (Elfenbein, 2007).

The range of temporal scopes evident across studies highlighted the unique affordance of video-recordings for capturing real-time affect unfolding in the interdependent behaviors of group members. Temporal scopes can be adjusted to the time-dynamic nature of the investigative phenomena (Klonek et al., 2019), from multifarious sequential and fleeting expressions otherwise difficult to access (Christianson, 2018), to collective constructs developing over time that contribute to more or less effective group behaviors. Yet, the actual feeling states, and experiences as perceived by team members themselves, are also critical to understanding the function of affect in tertiary CL and organizational settings, which points to the limitations of relying strictly on observations. For example, key data related to emotion management (i.e., emotional labor; emotion regulation) require individuals' readiness to divulge their inner feelings and reasons for particular behaviors (Näykki et al., 2014). Affect as expressed, and as experienced feeling states, are two different but complementary data sources that combined, can provide a fuller picture of the group dynamics puzzle. Any intervention aimed at addressing concerns related to affect in groupwork in CL and organizational teams would need to build on insight gained from a combination of external observations and subjective perspectives, since these do not always converge.

Another important but still largely unexplored area requiring observational and self-report data is the extent to which group members are cognizant of their own affective reactions in relation to others (Schneider et al., 2018), an issue also raised by Barsade (2002), with respect to group members' own emotional contagion. Combining observation and self-report methods can provide insight into "how perceptions and actual behaviors are related to one another" (Lehmann-Willenbrock & Chiu, 2018, p. 1156). The present review revealed that studies complemented by individual interviews directly targeting observed affect dynamics were particularly insightful to understand their functional role from the perspectives of the actors themselves. Importantly, participants also shed light on relevant contextual aspects beyond the researcher's purview.

Overall, there was converging evidence that employing multiple methods can help in managing challenges inherent to affect research in these contexts, including achieving reliability and validity (Mauss & Robinson, 2009). Physiological measures such as compact wearable devices as another internal measure, are increasingly being utilized (Kolbe & Boos, 2019). Yet, the difficulties of dealing with voluminous interaction data are also well known and as this review reflects, often addressed by quantifying coding to address research questions. However, coding can miss the dynamically interdependent nature of group processes such as the interactional maneuvers embedded in social interaction that may enable or inhibit some individuals expressing

particular categories (Bonito & Sanders, 2011). While quantifying coded data can reveal interactive trends and patterns within and across groups, “what is lost is the exploration of behavior beyond the specific research hypothesis at hand” (Lehmann-Willenbrock et al., 2017, p. 523), which was demonstrated in Isohätälä et al.’s (2019) study where valuable un-hypothesized findings from exploratory analysis were reported. Järvenoja et al. (2019) suggest physiological measures of sensory affect information may be useful in managing voluminous video-based data by identifying hot-spots for investigation. Another approach evident in some studies (e.g., Watzek & Mulder, 2018) is to combine quantitative and qualitative data by taking a slice of a larger dataset for in-depth qualitative exploration.

As with any research, this review has limitations. It did not investigate related elements such as group composition, the nature and value of the task, and time allocation, to name a few. These were not explored due to the deliberate focus on observational methods that have traced affect as socio-dynamic phenomena in the group process domain in two distinct but interrelated contexts. The role of affect in online groupwork, which has a sizeable body of research, was not examined as the aim was to address face-to-face interactions as naturally occurring in tertiary and work environments. Despite the growth of studies examining synchronic online interactions in groupwork, face-to-face modalities of interaction are pervasive in tertiary education and work contexts and deserve research attention for their criticality in shaping group functioning. Restricting the scope of the review allowed the space to closely scrutinize how affect dynamics have been investigated as sequentially unfolding in the interdependent micro-manifestations of peers working on shared tasks in the two target settings. This fine-grained approach illuminated how affect has been conceptualized, operationalized, and analyzed in order to trace its manifestation as social and dynamic interpersonal phenomena in two broad contexts. This systematic approach may be usefully expanded to other group situations to reveal commonalities, and alternative perspectives across different group types.

Future Research

Several points for future research were identified. Understanding emotion regulation as a *collective* and *dynamic process* in groupwork is critical (Menges & Kilduff, 2015) in light of the import given to socioemotional and collaborative skills development in education (Organisation for Economic Co-operation and Development (OECD), 2018) and the key role emotions play in how we perceive one another in social interaction (Pekrun, 2019). Affect in relation to interpersonal skills (IPS) was not explicitly examined in most of the studies reviewed, however its importance was implicit, for

example when discussed in terms of the interpersonal relational *quality* of teams and measured with self-report instruments tapping constructs such as cohesion (e.g., Bartel & Saavedra, 2000). Costa et al. (2017), however, directly investigated actual behavioral referents of favorable interpersonal behaviors in their group engagement study. In interpreting their findings, Costa and colleagues highlighted the key role of the capacity for emotion regulation, including the ability to recognize others' affective states, regulate team affect, and also important for group outcomes, to make productive use of both positive and negative affect. Several studies drew conclusions regarding a need for developing capabilities that fall under the IPS umbrella. For example, in their study of final year tertiary CL teams, Schneider et al. (2018) found affect awareness to be an important team ability. Gorse and Emmitt's (2009) workplace study noted a lack of communication skills in construction project teams; and Isohätälä et al. (2018) found that preservice teachers in their CL study appeared to lack the skills needed to effectively balance socio-emotional and argumentation processes.

Against this backdrop, emergent research on the current iGen³ (Twenge, 2017) suggests that these digital natives, while proficient in online social interaction, may lack social skills in face-to-face contexts. Empirical evidence that the iGen cohort engages in less face-to-face peer interaction than previous generations (Turner, 2015; Twenge et al., 2019) is consistent with claims (Knoll, 2014) that consequently, they may have limited competence for conflict resolution in such contexts. Empirical research is needed to understand the real picture. While research on online affect dynamics has unsurprisingly gained momentum in recent years, research on affect in face-to-face contexts is underexamined even though this form of interaction remains an important part of social life including educational and workplace environments.

Mentioned earlier, only four studies examined affect explicitly for its function in interpersonal relations in addition to interpersonal affect in service of the task. The scant attention paid to the social relational domain in regard to affect was also noted in Van Kleef & Fischer's (2015) review of emotions in groups, which observed the need for research on the social context including norms, intragroup relations, power and status issues, and cultural aspects, requiring data collection methods beyond observations alone. Affect dynamics in group settings beyond those explored in this review may be instrumental for future research in educational and organizational contexts. For example, though it may (traditionally) be assumed that these are generally low-intimacy environs, research conducted in higher intimacy groups (e.g., friendship, social groups) may broaden the relational perspective of affect dynamics and contribute to allaying normative assumptions regarding social interaction in education and organization contexts that could inadvertently limit the research scope.

Not only relational development, but its absence in groupwork warrants investigation (Keyton, 2000). This may be particularly relevant to tertiary contexts such as first year university during which the social can be particularly salient (Mamas, 2018). Volet et al. (2019) noted the extent to which students' affect expression influenced one another in first year groupwork, impacting group task motivation. Future research needs to explore the relational domain of groupwork given that "group tasks are not accomplished by task knowledge or skill alone" (Keyton, 2000, p. 389), a turn of century observation more relevant than ever 20 years on. Moreover, in their comprehensive groupwork review Kozlowski and Ilgen (2006, p. 95) argued that what groups actually do, their coordinated efforts in adapting to changing and unforeseen circumstances in achieving work goals, denotes group performance as "an active, dynamic, ongoing process rather than a retrospective evaluation."

Surprisingly, this review identified only one study (Lehmann-Willenbrock et al., 2014) that addressed intercultural issues related to affect in group behaviors. In light of the centrality of cultural diversity and intercultural interaction in contemporary workplaces, and sociocultural research highlighting meaningful differences in expressions of affect across cultural groups (e.g., Kuppens et al., 2017), research is needed on interpersonal affect in culturally diverse groups. This is an under-researched yet critical area.

In practical terms and across the studies, the black box of group dynamics was effectively opened in both experimental and real-life group contexts, pinpointing seemingly inconsequential, often taken for granted affect expressions that contributed more or less helpfully to group functioning in the two contexts explored in this review. Together they offer several avenues for examining and raising group effectiveness. Both research groups identified in this review as having made major contributions to research on affect dynamics in groupwork have also developed intervention coaching tools, used with university CL groups (e.g., Järvenoja et al., 2017) and in the workplace (e.g., Lehmann-Willenbrock & Kauffeld, 2010).

In advancing the field of groupwork effectiveness, researchers continue to argue that in addition to the need for more experimental research and large quantitative studies, rigorous descriptive qualitative research in real-life contexts, can inform development of theoretical and empirical research (e.g., Keyton, 2000; Klonek et al., 2019; Kozlowski, 2015). In this regard, Klonek et al. (2019) argued that reviewers and editors can play a key role in recognizing the inevitable messiness of real-life situations, and in appreciating the contributions that such research can make in advancing understanding of group process dynamics. In a field where much remains to be known about how workgroups function, this review contributed to the

literature by synthesizing studies that have used observational methods to examine affect as socio-dynamic phenomena in tertiary and workplace face-to-face groupwork.

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Supplemental Material

Supplemental material for this article is available online.

Notes

1. Team and group (or teamwork and groupwork) are used interchangeably.
2. Two groups of scholars active in research on affect in groupwork were identified: Järvelä and colleagues in educational psychology; and Lehmann-Willenbrock and colleagues in organizational psychology. A sample of articles fitting the targeted phenomena for the review were selected from each group, ensuring representation of the range addressed while avoiding replication.
3. The iGen, also known by other terms (e.g., Generation Z) indicates those born post-1995 to late-2010's, the first generation growing up with smart-phones, therefore with ever-present Internet and social media (Twenge, 2017).

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